ART. II. NEW SILURIAN SCOLECODONTS FROM THE ALBION BEDS OF THE NIAGARA GORGE, NEW YORK

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Plates I-VII

Of the five thousand Scolecodonts, fossil polychæte annelid jaws, examined in this study, more than ninety per cent were found to be broken or badly crushed out of shape. Preliminary sketches were made of about five hundred good or usable forms. All specimens which were broken or which might leave a slight doubt as to their true shape were rejected.

The specimens were collected along the tracks of the Lewiston Branch of the New York Central Railroad, just north of the tunnel near the mouth of the Niagara Gorge, about one-half mile south of Lewiston, New York. They came from the thin-bedded, calcareous sandstone layers of the Manitoulin Beds, Albion formation, Medina Group, of Silurian age. The Manitoulin beds are about thirty feet thick and consist of dark greenish shale, thin-bedded argillaceous magnesian limestone, and thin, calcareous sandstone layers. Fossils are scarce in these beds. The Scolecodont horizon is from about twenty to twenty-five feet above the Whirlpool sandstone.

The layer containing the jaws was discovered by Mr. Raymond B. Hibbard, of Buffalo, New York, while searching for Bryozoa. When the Scolecodont layer is exposed, it becomes covered with a soft crust of calcareous mud which conceals the specimens from view in ordinary prospecting. To find the fossil jaws it is necessary to wash the mud from the rocks. This, of course, destroys many of the specimens. Scolecodonts were known to occur in the Niagara Gorge and the writer had spent a great deal of time searching for them and is therefore indebted to Mr. Hibbard for disclosing their exact locality. Thanks are also due to Mr. Max Kopf of Lancaster, New York, and to Mr. Hibbard for their assistance in collecting the specimens.

The sandstone layer containing the Scolecodonts is finely grained and in places calcareous. The amount of cementing material in the

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matrix seems to vary. Scolecodonts are of a chitinous-like material and a weak solution of hydrochloric acid does not affect them except in some cases where a small bubble of carbon dioxide will form directly beneath and may break the delicate jaws. A very small needle, sharpened to the finest point possible, was used to loosen the matrix around the jaws, and to clean out the muscle fossa and remove the material between the denticles. This also helped to keep the liberated gases from breaking the specimens. Whenever possible the jaws were taken from the matrix so that both surfaces could be studied, since it was found that satisfactory determinations cannot be made without seeing all surfaces. Broken specimens may be repaired by using a very thin solution of celluloid and acetone.

The jaws in this collection are relatively small in size. There is a lack of material belonging to maxillæ III and IV, and since much of the material is small, thin, and fragmentary, it is possible that the proximal maxillæ were too fragile for preservation.

The collection, including the type specimens of the new species, is in the Carnegie Museum.

DESCRIPTION OF SPECIES

Genus LUMBRICONEREITES, Ehlers, 1868

Lumbriconereites hibbardi sp. nov.

Maxilla I, plate I, figs. 1-9

Asymmetrical right and left jaws are present. The jaw is wide and elongate, being widest at the mid-region but narrowing to an acute posterior extremity. There are generally seventeen large, backward-pointing denticles which extend along the inner margin nearly to the posterior end. The inner margin, when viewed directly from the lower side, curves at the anterior end at about the third or fourth denticle and continues in a straight line to the posterior extremity. The denticles are often irregular in shape, being either round and blunt, or triangular, flat, and pointed. They usually decrease in size posteriorly. Specimens range from 1.0 mm. to 2.1 mm. in length. The hooked-shaped fang is large and is a continuation of the heavy outer margins, which are thickened, especially toward the anterior end. On the right jaw the outer margin is notched by a crescent-shaped bight which forms a shank; the left jaw is rounded and has but a slight suggestion of a bight beginning at a point just anterior to the mid-point. The inner surface, especially near the denticles, is often concave while

the outer surface is convex, except for the fossa. The fossa is wide anteriorly but narrows acutely at the posterior extremity. The margins of the fossa are well rounded thus enabling the jaw to be twisted considerably by the muscle.

This species resembles *Lumbriconereites obliquus* Eichwald (1854), in nearly all of its characteristics, but there are some differences which exist in the several scores of specimens examined. *Lumbriconereites hibbardi* is much wider. The inner margin of the jaw is not so straight as that of *Lumbriconereites obliquus*, as shown in Hinde's figures. The fossa of *Lumbriconereites hibbardi* is much wider and is well rounded anteriorly. The inner surface (upper surface of Hinde), which bears the inner margin and the denticles, is in the form of a gently sloping ridge, while in *Lumbriconereites hibbardi* this area, especially on the inside of the curved inner margin, is concave. There is a slight resemblance between *Œnonites major* Hinde (1882) and *Lumbriconereites hibbardi* (left jaws). Stauffer (1933) figured a number of specimens from the Middle Ordovician of Minnesota under two generic names, *Lumbriconereites* and *Protarabellites* and several specific names, *Lumbriconereites cameratus*, *Lumbriconereites affinis*, *Protarabellites delectus*, *Protarabellites concavus*, and *Protarabellites productus* which are similar to *Lumbriconereites hibbardi*. *Lumbriconereites austini* Foerste (1888) resembles *Lumbriconereites hibbardi*, except that the denticles are less pronounced, and the bight on the outer margin is much deeper. An undescribed jaw figured by Searight (1923), (plate I, fig. 5) is similar to *Lumbriconereites hibbardi* in some ways. *Lumbriconereites cooperi* Eller (1938) corresponds well, except for the type of denticles, surface details, and width of jaw, with *Lumbriconereites hibbardi*. Both have the difference in shape of the right and left jaws. The muscle fossa and arrangement of the denticles are similar in both species.

Genus EUNICITES, Ehlers, 1868

Eunicites vertex sp. nov.

Maxilla II, plate III, fig. 6

The jaw is elongate and is widest at the mid-region. A straight inner margin bears a series of fourteen sharp, conical or hooked denticles which decrease slightly in size posteriorly but do not reach the end of the jaw. The first few denticles point slightly forward or are

perpendicular to the inner margin; the remaining ones are directed backward. The first denticle is small and adheres to the second one. The anterior end is acute while the posterior end is quite blunt. In the posterior half of the jaw the outer margin is curved slightly to form a small shank and then gently curved to the posterior extremity. A small, rounded ridge is discernible along the posterior part of both the inner and outer margins. The lower surface is irregular and concave at the posterior end.

No other species resembles this form closely. Hinde described a species, *Staurocephalites serrula* Hinde (1880) but later placed it in the genus *Eunicites* (1882). This species, according to both of Hinde's papers, is of the same general type as *Eunicites vertex*. *Staurocephalites niagarensis* Hinde (1879), which might possibly belong to the genus *Eunicites*, is similar to *Eunicites vertex*. Stauffer (1933) described several forms, *Staurocephalites acutidentatus* Stauffer, *Staurocephalites dentatus* Stauffer (fig. 32), and *Staurocephalites antiquus* Stauffer which are of the same general character as *Eunicites vertex*. *Eunicites acuminatus* Eller (1934) resembles *Eunicites vertex* except that the former has a wider anterior end and a more acute posterior extremity.

Eunicites petasus sp. nov.

Maxilla I, plate III, figs. 7-8

The jaw is in the form of a simple forceps without denticles on the inner margin. In cross-section the jaw is nearly round. The posterior end is very wide and tapers anteriorly to a pointed fang which is slightly hooked. The fossa is very large and round. The margins around the fossa are usually broken but there is evidence that they were thick and the edges well rounded.

Jaws or forceps of this kind are common in many genera of recent and fossil polychæta. Hinde (1879) (1882) described a form *Eunicites simplex* Hinde which is similar except that the posterior end is wider and the fang not so hooked. *Hyalinœcites subulatus* Stauffer and *Hyalinœcites plenus* Stauffer (1933) resemble *Eunicites petasus* in a general way. If the description of Stauffer's genus *Hyalinœcites* was not so specific, *Eunicites petasus* might be included under that category. Except for its very short body, *Arabellites ? conus* Eller (1938) resembles *Eunicites petasus* in its other characteristics. The writer feels that those species having a simple forceps of this kind should probably be grouped under a new genus but hesitates to do so at the present time.

Leodicites gen. nov.

Maxilla II, plate VII, figs. 1-4

This genus includes those forms in which the jaws of maxilla II are without a fang or primary denticle. The jaw is medium in size, more or less triangular in shape, and may be either highly convex or flattened. A straight or curved inner margin bears a series of denticles which are variously shaped and which are not always uniform in arrangement. The anterior margin is round or slightly incurved to form a blunt or an acute shank. A large bight or indentation is present on the outer margin just posterior to the shank. The fossa is large and may occupy from one-half to three-quarters of the jaw length.

Genotype, *Leodicites variedentatus*, n. sp.

It is with some hesitation that the writer has concluded to erect a new genus for jaws of this type. Jaws of this kind were originally included by Hinde (1879) under the genus *Arabellites* but were later placed by him (1882) in the genus *Eunicites*. He (1879) described several species, *Arabellites lunatus* Hinde, *Arabellites cristatus* Hinde, *Arabellites cervicornis* Hinde, *Arabellites similis* Hinde, and *Arabellites politus* Hinde, which possess this type of jaw and might perhaps be referred to this genus. In looking over the literature on recent forms, I have found that jaws of this kind, *Leodicites*, maxilla II, exist in many recent genera. Some recent genera which have a maxilla II of this type are *Onuphis*, *Leodice*, *Œnone*, *Nematonereis*, *Eunice*, *Diopatra*, *Paramorphysa*, *Aracoda*, *Marphysa*, and *Lysidice*. *Leodicites* is similar to *Ildraites* except that it does not have a fang and is a maxilla II. *Ildraites* has a prominent fang and is a maxilla I. The posterior areas of both genera are similar.

Leodicites variedentatus sp. nov.

Maxilla II, plate VII, figs. 1-4

The jaw is rudely triangular in shape and measures from .61 mm. to 1.1 mm. in length. Along the curved inner margin a series of eleven to fifteen, sharply pointed, conical denticles extends practically to the narrow but blunt posterior extremity. The denticles are not uniform in size but usually point in a backward direction. A small or medium sized first denticle is often supplemented by a larger, second or third denticle. The second, fourth, and fifth denticles may be small or minute. The remainder of the denticles are larger and decrease

regularly in size toward the posterior end. The anterior margin is rounded from the fang and then slightly incurved to a pointed shank. A deep, crescent-shaped bight on the outer margin emphasizes the acuteness of the shank. The fossa is deep, fairly wide, and extends for about two-thirds the length of the jaw. A thickened margin with well rounded edges is present around the fossa. The upper surface is highly convex and the lower surface is flattened or slightly concave.

Leodicites variedentatus resembles *Arabellites similis* Hinde (1879) and *Eunicites cristatus* (Hinde) (1882). There is a slight resemblance between *Leodicites variedentatus* and *Eunicites hebes* Hinde (1882). Stauffer (1933) described a species, *Arabellites contritus*, which seems to agree rather well with *Leodicites variedentatus* in some of its details. *Arabellites magnificus* Stauffer, *Arabellites falciformis* Stauffer and several other similar species of Stauffer (1939) conform in many ways with *Leodicites variedentatus.*

Genus ARABELLITES, Hinde, 1879

Arabellites oviformis sp. nov.

Maxilla I, plate I, figs. 10, 11

The jaw is oblong and has parallel margins. With the fang, there are from eight to twelve, conical, blunt or sharply pointed, backward directed denticles which extend to the posterior end of the inner margin. The denticles usually decrease slightly in size posteriorly. The strongly hooked fang is of medium length. The posterior extremity of the jaw is obliquely truncate. The inner margins are straight with well rounded edges. In most specimens the inner margin, which bears the denticles, is quite close to one of the outer margins. The lower surface is only gently convex and may be slightly concave in the central part parallel to the length of the jaw. Except for the fossa, the upper surface is convex. A large, shallow fossa, just posterior to the fang, is present and has a broad and well rounded anterior part. It narrows slightly to the posterior extremity. An average specimen is 1.3 mm. in length.

The fossa of *Arabellites rectidens* is similar to that of this species but the other characters, such as general outline, size, position of the denticles and hook, do not correspond. In most species of *Arabellites* the fossa is not known or has not been included in the descriptions or figures. Where known, it is usually found only in the posterior third. *Arabellites oviformis* is thus very interesting because of the large fossa which extends to the anterior part. The general outline, denticles, fang, and lower surface, are similar to other species of *Arabellites.*

Arabellites plenidens sp. nov.

Maxilla I, plate II, figs. 12, 13

The jaw is narrow and elongate, measuring from 1.7 mm. to 2.5 mm. in length. There are from eighteen to twenty-one, small, sharp or blunt denticles extending along the inner margin almost to the rounded posterior extremity. The denticles are directed backward with no appreciable decrease in size at the posterior end. The fang is short and in the smaller specimens thin and sharply pointed but thick and blunt in the larger jaws. The outer margin of the jaw is nearly straight or gently curved. The upper surface is convex and quite smooth; the lower surface is irregular. A rather large fossa is located in the posterior third of the jaw. The anterior end of the fossa is deep and wide but becomes narrow and quite shallow posteriorly. The margins around the fossa are thickened and the edges rounded.

No other forms correspond closely to this species. This is due to the narrowness of the jaw, the large number of denticles extending from the anterior to the posterior extremities, and the short, abruptly hooked fang. The jaws are rather large for this fauna, being nearly twice the size of any other species in this collection.

Arabellites rectidens sp. nov.

Maxilla I, plate III, figs. 1-5

The jaw is oblong in its general shape but rather irregular in outline. The inner margin is formed by a low ridge on the lower surface. It bears a series of six, sharp, backward directed denticles which do not reach the posterior end. The elongate fang does not form a hook but points in a more forward direction. The posterior end is widely truncate but is thin and broken in most specimens. The inner margins are thick with the edges well rounded. The under surface is convex, as is the upper one except for the concave fossa. Typical specimens measure about 1.0 mm. in length.

There is a surprising similarity between this form and *Arabellites spicatus* var. *contractus* Hinde (1880) from the Wenlock group of England, later changed by Hinde (1882) to *Arabellites contractus* in the description of the forms from the Silurian of Gotland. *Arabellites rectidens* differs only in the smaller size of the fossa, the thicker outer margins of the jaw, and the lesser number of denticles. *Arabellites spicatus* Hinde (1880) has "an elevated spike-like projection at the corner of the base," which makes it, together with the differences men-

tioned for *Arabellites contractus* (1882), dissimilar to *Arabellites rectidens*. *Arabellites spicatus* Hinde (1882) from the Silurian of Gotland may be differentiated from *Arabellites rectidens* by the short, thick fang and the deep indentation or bight at the posterior end of the jaw. Except in side view, *Protarabellites hamiltonensis* Stauffer (1939) is similar to *Arabellites rectidens*.

Genus NEREIDAVUS, Grinnell, 1877

Nereidavus invisibilis sp. nov.

Maxilla I, plate II, figs. 1-11

The jaw measures from .57 mm. to 1.70 mm. and is elongated. A series of often more than fifty, extremely small, needle-shaped denticles is on the inner margin. Starting close to the first denticle or fang, the denticles either point backward or are perpendicular to the inner margin. They are very compact and extend only two-thirds the length of the jaw. On some jaws the denticles appear to be missing, while on others there are only stubs, often on the under side of the margin. The denticles measure about .016 mm. in diameter. It is probable that in many cases they were broken off during burial, although in some specimens the denticles seem to be just small, rounded, tubercle-like teeth. The denticles are not uniform in length, longer ones may appear almost any place along the margin but usually they are found in the anterior end. The fang is short, either heavy and quite straight or thin and strongly hooked. The fang is more or less oblique to the plane of the lower surface of the jaw, often approaching a right angle. The inner margin, which is straight or gently curved, usually incurves abruptly to the fang. The outer margin is straight or slightly curved. The posterior of the left and right jaws differs fundamentally. In the right jaw the posterior is truncate while in the left jaw there is a large bight in the outer and posterior margins. This bight in the posterior part radically changes the shape of the fossa. In the left jaw the deep fossa which is rounded anteriorly, narrows abruptly, and follows the area near the inner margin to the posterior end. The fossa in the right jaw is deep and rounded but becomes shallow or convex posteriorly. This shallowness is reflected by a convex area on the lower surface. A wide and heavy margin, often flattened but with rounded edges, surrounds the fossa in both left and right jaws. The upper and lower surfaces are irregularly convex but near the fang on the lower surface the jaw is often quite flattened and concave.

The majority of the specimens in the present collection are of this species. As is often the case in scolecodonts, the right and left jaws differ from each other. If only a few specimens were available, and if

it were not possible to take some of them from the matrix, it is conceivable that four species might be described from the present material. Dr. Hinde placed forms of this kind in the genus *Œnonites*, but the writer feels, at least for the present, that they belong in the genus *Nereidavus*. However, they have many characteristics of the genus *Arabellites*. Hinde (1882) described a form, *Œnonites aspersus* Hinde, from the Silurian of Gotland which is similar to this species in most of its characteristics. Both forms have the same outline, the same type of fang which is in a position oblique to the plane of the jaw, and both have very minute denticles. They differ chiefly in the anterior part. In *Œnonites aspersus* Hinde, the denticles continue along the inner margin to the end of the jaw, while in *Nereidavus invisibilis* they stop about one-third the distance from the end of the jaw. The fossa of the left jaw of *Nereidavus invisibilis* is much wider and more rounded in the anterior part than in *Œnonites aspersus* Hinde. *Nereidavus antiquus* Hinde (1880), and *Nereidavus perlongus* Eller (1934), resemble *Nereidavus invisibilis* in a general way. Zebera (1935) described the species, *Arabellites perneri* Zebera and *Arabellites kettneri* Zebera, which have a similarity to *Nereidavus invisibilis*. From the figures, it is apparent that the posterior extremities in Zebera's specimens are missing, which makes it difficult to form definite conclusions. The anterior end of *Pronereites naviculiformis* Zebera (1935) is similar to that of *Nereidavus invisibilis*. In its general characteristics, *Nereidavus invisibilis* is similar to *Nereidavus ontarioensis* Stauffer (1939).

Genus ŒNONITES, Hinde, 1879

Œnonites parvidentatus sp. nov.

Maxilla I, plate III, fig. 9

The outline of the jaw is irregularly triangular. Anterior to the mid-region the jaw widens. The inner margin is straight and bears a series of twelve, blunt, backward-directed denticles which posteriorly decrease irregularly in size. The fang is small and points forward. The outer margin is well rounded anteriorly and curves to an irregularly-shaped shank. Posterior to it is a small bight. The inner and outer margins form an acute posterior extremity. The lower surface is slightly concave and the upper surface, containing the fossa, is convex.

This form is similar to *Œnonites curvidens* Hinde (1882, fig. 32), especially the outer margins. Except for the outer margin, *Œnonites*

kopfi m. resembles *Œnonites parvidentatus*. The fang and denticles are very much alike. *Œnonites parvidentatus* is similar to *Œnonites dignus* Stauffer, *Œnonites tacitus* Stauffer, and *Œnonites inornatus* Stauffer (1933), but the outer margin is quite different.

Œnonites levis sp. nov.

Maxilla II, plate III, fig. 10

The jaw is small and sub-triangular in shape. Along the inner margin a series of eleven, sharply pointed, conical, slightly backward directed denticles extends to the posterior extremity. On the whole, the denticles are rather large for the size of the jaw. The first denticle or fang is rather small but the second denticle is larger than any of the others. The next two denticles are blunt but wide and were probably broken off at some time, then worn round. The remaining denticles become slightly smaller toward the posterior end. The outer margin is angular in outline and bears a small shank or angular process just anterior to the mid-region. The lower surface is convex except in the area of the shank where it is flattened. A narrow fossa is present just anterior to the shank.

In a general way this species resembles a form described by Hinde (1880) as *Arabellites pectinatus* Hinde from the Cincinnati Group at Toronto, Ontario. *Œnonites tacitus* Stauffer and *Œnonites inornatus* Stauffer (1933) have the same general outline but differ in the shape of the denticles.

Œnonites albionensis sp. nov.

Maxilla II, plate III, fig. 11

The jaw is oblong and tapers posteriorly to form an acute end. Along the inner margin is a series of twelve to fourteen, blunt, angular denticles which extends almost to the posterior extremity. The fang, which begins some distance from the anterior end, is not large and is usually perpendicular to the inner margin. The next one or two denticles are minute. Following these, the denticles are large, point back, and gradually decrease in size to the posterior end. The outer margin is irregular. At the anterior end a large shank is present, followed by the usual bight. The margin continues in a straight line to the posterior end where it curves slightly. The surface of the upper and lower sides is gently convex. The fossa extends from the shank to the posterior extremity.

These jaws do not seem to agree closely with any other known forms.

The presence of a shank on the outer margin is similar to that of *Œnonites kopfi* m. and *Œnonites fornicatus* m., but the anterior end is unlike these.

Œnonites coalescens sp. nov.

Maxilla I, plate III, fig. 12

The jaw is elongate and is widest at about one-third the distance from the anterior end. Both anterior and posterior ends taper gradually to acute points. The inner margin is gently curved and a series of nineteen, pointed, conical, and triangular-shaped denticles extends almost to the posterior extremity. The fang is long and thin. The second denticle is smaller but heavier than the first. It is braced in such a manner that it probably acted as a support and together with the first, functioned as the fang. Both of these denticles are either perpendicular to the inner margin or are directed slightly forward. A space exists between the second and third denticles. The next three or four denticles are small but increase in size gradually to about one-third the distance from the posterior end. From this point there is a rapid decrease to the last denticle, which is minute. The outer margin is curved from the anterior end to the widest part of the jaw and then gently incurved to the posterior end. The lower surface is convex except for the mid-region where it is slightly flattened. The upper surface is convex or nearly flat. The fossa extends from about the mid-point to the posterior end.

It is rather difficult to determine whether this form belongs to the genus *Eunicites* or *Œnonites*. Species, similar to the form described above, have been placed in both of these genera. However, in reviewing the literature, it is apparent that for forms of this kind more species have been described under the genus *Œnonites* than under *Eunicites*. The species conforms satisfactorily to the following analysis of the genus by Hinde: "Jaw with a more or less curved anterior hook, followed by a series of smaller teeth, similar in character to those of the existing genus *Œnone*." Hinde (1879) described several specimens from the Cincinnati Group of Toronto, Canada, as *Eunicites varians* (Grinnell). These jaws in outline are similar to *Œnonites coalescens*, but differ in the width of the jaw and the type of denticles. If these specimens of *Eunicites varians* (Grinnell) could be seen from the other side, they might prove to be altogether different types. Species of a similar nature, *Eunicites contortus* Hinde and *Eunicites clintonensis* Hinde (1879), were subsequently found by Hinde (1882) to be side views of *Lumbriconereites obliquus* Eichwald. *Œnonites*

curvidens Hinde (1872) resembles *Œnonites coalescens* rather well except for the outer margin which has, according to Hinde, "in the central portion an inflated, obliquely directed, process. The denticles are similar, especially the closeness of the second denticle to the fang." Specimens of the same species, Hinde (1879), from the Cincinnati Group from Toronto, Canada, do not correspond so well. Caley (1936) described a species, *Eunicites trentonensis* Caley which is similar to *Œnonites coalescens* except that the anterior area is not so wide and the first few denticles are of a different character.

Œnonites staufferi sp. nov.

Maxilla II, plate III, fig. 13

The jaw is narrow at the anterior end, increasing in width toward the mid-region, and then tapering to an obtuse posterior extremity. On the inner margin, a series of sharp triangular shaped, backward pointing denticles extends almost to the posterior end. The denticles are large anteriorly but rapidly decrease in size toward the posterior region. The fang is small and abruptly hooked. The outer margin is irregular and curves gently to the fang. The upper and lower surfaces are irregular. The fossa extends from about the mid-region to the posterior end.

This species does not resemble very closely any other known form. *Œnonites regularis* Hinde (1880) is similar but it has a more angular outline. *Œnonites excelsus* Stauffer and *Œnonites paratus* Stauffer (1933) are slightly similar to *Œnonites staufferi.* The maxilla II of *Arabellites alfredensis* Eller (1934) resembles, especially in the anterior region, that of *Œnonites staufferi.*

Œnonites fossulus sp. nov.

Maxilla I ?, plate III, fig. 14

The jaw is long with the anterior end tapering to a long, acute extremity. Along the inner margin is a series of nine, rather large, blunt, backward pointing denticles which extends nearly to the posterior end. The fang is large and is situated at about one-third the distance from the anterior end. It is directed backward in an acute angle with the inner margin. The second denticle is minute. The outer margin is nearly straight; the inner margin is gently curved. An elongate fossa is present on the upper surface. It begins anterior to the fang but does not continue to the end of the jaw, stopping at about a third of the distance from the last denticle. The lower surface is gently convex.

Only one specimen of this species is present in the collection and it is broken into four parts. All but the anterior tip was recovered. The jaw is quite different from that of other forms, especially in the anterior region with its long and sharply pointed extremity and the acutely, backward directed fang. Even though it is badly broken, the writer feels this specimen should be figured and described. *Staurocephalites serrula* Hinde (1880, fig. 20) later recorded as *Eunicites serrula* (Hinde), 1882, is similar to *Œnonites fossulus*, except that it does not have the anterior end extended so much. Stauffer (1933) describes a form, *Staurocephalites dentatus* Stauffer, fig. 32, which also is slightly similar to *Œnonites fossulus*.

Œnonites kopfi sp. nov.

Maxilla II, plate IV, figs. 1-3

The jaw is triangular in outline, measuring in average .8 mm. in length. In most specimens the inner surface is rather flat while the outer is quite convex. The inner margin, bearing the denticles, is straight from the anterior end for about two-thirds of its length, at which point it arches slightly and, with the outer margin, forms a slightly concave area. There are from 16 to 19 denticles on the inner margin. The fang, or first denticle, is small, conical, and slightly curved and points in a forward direction. Following it, there is a series of small, blunt, compact denticles which extends to the end of the jaw. In most specimens the denticles are uniform in size, perhaps slightly decreasing toward the posterior end. The outer margin is round and thick, except at the anterior end. At the posterior end, on the right side of a left jaw and on the left side of a right jaw, the outer margin is much wider and forms a flange which is one side of the rim of the concave area. The outer margins enclose a large fossa which extends two-thirds of the length of the jaw. The fossa is wide and rounded anteriorly but becomes narrow at the posterior end.

This species is common in the fauna. The large fossa makes the jaw a very formidable, grasping apparatus. Hinde, 1882, described a form, *Œnonites radula* Hinde from the Silurian of Gotland, which resembles this species in so many ways that the writer was tempted to place it under that category. It differs, however, in the structure of the outer margin. In Hinde's species the margins unite anteriorly and acutely to form the fang, whereas in *Œnonites kopfi* the margin follows the rounded fossa and is not so prominent anteriorly. The fang of *kopfi* does not seem to be in the same plane or a part of the

outer margin, as in Hinde's species. The inner surface of *Œnonites radula* Hinde is more concave than *Œnonites kopfi*. From the figures of *Œnonites radula* Hinde it appears that the denticles in this species do not extend the full length of the inner margin; in *Œnonites kopfi* more denticles are present and they extend the full length of the margin. There is a general resemblance between *Œnonites alpenœnsis* Eller (1938) and *Œnonites kopfi*, although the outer margins and the denticles do not correspond. The flange on the outer margin of *Œnonites kopfi* is similar to a structure found on the variety described by Hinde (1882) as *Œnonites radula cristula* Hinde.

Œnonites fornicatus sp. nov.

Maxilla II, plate IV, figs. 4-6

In outline, the jaw is a curvilinear triangle and its margins taper posteriorly to form either an acute or an obtuse angle. Both the inner and outer surfaces are convex. The inner margin bears a series of small, blunt, fairly compact denticles along the first three-quarters of its length. The number of denticles varies between thirteen and fifteen; the majority of jaws, however, bear fifteen. The denticles are rather uniform, with only slight reduction in size posteriorly. The fang is small, conical, straight or slightly hooked, and usually points in a forward direction. The anterior margins are irregularly curved; the anterior part is extended into a pointed shank. The fossa is large and extends nearly the full length of the outer margin.

These jaws probably represent maxilla II and were used for crushing as well as grasping. The large fossa with its muscle made the jaw very powerful. The form is similar to *Œnonites kopfi* m. in general shape, but its outlines or margins are not so straight and the presence of a shank make it a distinct species. There are also fewer denticles and they do not extend to the posterior end as in *Œnonites kopfi*. The inner surface of *Œnonites kopfi* is quite flat, while the same surface of *Œnonites fornicatus* is convex. *Œnonites radula* Hinde (1882), is similar to *Œnonites fornicatus* in size and especially in the arrangement of the denticles. *Œnonites fornicatus* differs from *Œnonites radula* Hinde in the irregularity of the margins, the convexity of the inner surface, and the presence of a distinct flange on the anterior part of the outer margin. In *Œnonites securis* Hinde (1882), the front portion is curved and continues into an upward projecting shank somewhat similar to that of *Œnonites fornicatus*. The outer margins of *Œnonites fornicatus* remind one of *Œnonites alpenœnsis* Eller (1938).

Œnonites peracutus sp. nov.

Maxilla I, plate IV, figs. 7, 8

The jaw is narrow, triangular in outline, and has straight margins that curve posteriorly to form a slightly obtuse but not truncate posterior extremity. Including the fang, there are usually a series of eighteen denticles which begin well to the anterior end and extend along the inner margin almost to the posterior end. The denticles are of various shapes. Those at the anterior end are long, conical and sharp, while those at the posterior end are often small, blunt, and compact, but in some specimens they may be slightly hooked. Many of the denticles have the appearance of being worn or broken and this may be the reason for the various shapes and sizes. A long, thin, rather straight, sharply pointed fang is directed from the jaw at about right angles with the inner margin. The fossa is broadly oval, deep, medium sized, and located in a plane more perpendicular to the denticles than parallel to them. The margins of the fossa are thickened into a round or slightly flattened rim. An average specimen measures 1.3 mm. in length.

This rather delicate species is represented by only a few complete specimens and a number of fragments. It does not resemble any other species very closely due to the position and character of the fossa and the number and arrangement of the denticles. The jaws have certain characteristics which are common to the genus *Arabellites* and the writer was hesitant to place it in the genus *Œnonites*. There is a slight similarity between *Œnonites ? infrequens* Hinde (1879) and the lower surface of *Œnonites peracutus*. If the upper surface of *Eunicites trentonensis* Caley (1936) were known, it might resemble *Œnonites peracutus* except for its larger denticles.

Œnonites flexus sp. nov.

Maxilla I, plate IV, figs. 9, 10

The jaw is elongate with a straight inner margin and a gently curved outer margin. There are from twelve to sixteen, sharp, or blunt, conical shaped denticles distributed along the inner margin almost to the posterior extremity. The large conical, sharply pointed fang, and often the adjacent denticle, points in a forward direction. The remainder of the denticles point backward and usually diminish in size posteriorly. The last few denticles are often minute. The fossa is long and oval in shape and extends almost the complete length of the jaw.

Hinde (1879) described a species, *Œnonites amplus* Hinde from the

Clinton of Dundas, Ontario, which is very similar in its general shape to *Œnonites flexus* but which differs in the arrangement of the denticles, the width of the jaw, and the straightness of the outer margin. *Œnonites naviformis* Hinde (1880, 1882) from England and Gotland, corresponds in a general way but is not closely related due to the presence of a notch or a bight on the outer margin. Searight (1923) figures (plate I, figure 1), but did not name or describe, a form which is similar to *Œnonitus flexus* except that the outer margin is not as gently curved, the fossa is not in the same position, and the fang is curved backward instead of pointing forward. Stauffer (1933) described three similar forms, *Œnonites tacitus* Stauffer, *Œnonites dignus* Stauffer, and *Œnonites inornatus* Stauffer which generally may be correlated with *Œnonites flexus*. *Œnonites orthodontus* Eller (1938) is similar to *Œnonites flexus*, particularly in the arrangement and form of the denticles, but it differs in the acuteness of the anterior end and in the prominence of the fang.

Œnonites exactus sp. nov.

Maxilla I, plate IV, figs. 11, 12

The jaw is elongate and widest at the anterior end but narrows gently to form a slightly hooked posterior extremity. The inner margin is straight except for the most posterior part which curves gently. Along the inner margin a series of from fourteen to sixteen, sharp, conical, backward pointing denticles extends almost to the posterior end. The fang, or first denticle, is only medium sized and it is followed by a very small denticle. The next denticle in the series is very much larger than any of the others and was probably used more as a fang than as the first tooth. Next in order are two small denticles followed by three larger ones. The remaining denticles are of various sizes except at the posterior end where they gradually decrease in size and become minute. The third denticle appears to begin well toward the outer margin and because of its large size a concave area is present just posterior to it. The outer margins are curved and their edges well rounded. The upper surface, except for the fossa, is convex, and the lower surface is flat or slightly concave. The fossa is oval in shape at the anterior end and tapers to an acute posterior extremity. The fossa begins about one-third of the distance from the anterior end and well behind the large, third denticle.

The interesting feature of this species is the consistency in number and the diversity in sizes of the denticles in all the specimens examined. No particularly close relationships to this species have been noted.

However, several species have a general similarity to *Œnonites exactus*. *Œnonites amplus* Hinde (1879) from the Clinton of Ontario is an example. Several specimens described as *Œnonites naviformis* Hinde (1880, 1882) may be brought into this category. The figured, but undescribed form from the Cedar Valley Limestone of Iowa, Searight (1923, plate I, fig. 1), is similar to *Œnonites exactus*. Three specimens described by Stauffer (1933) from the Middle Ordovician of Minnesota, *Œnonites dignus* Stauffer, *Œnonites inornatus* Stauffer, and *Œnonites tacitus* Stauffer, may be considered as having slight similarity. If *Lumbriconereites cooperi* Eller (1938) is viewed from the upper side, (Plate XXVIII, fig. 3), it would show a close resemblance to *Œnonites exactus*. In outline, shape of fossa, and arrangement of the denticles *Lumbriconereites cooperi* is quite similar and might easily be mistaken for *Œnonites exactus*. However, if *Lumbriconereites cooperi* Eller or any other related forms are viewed from the under surface, it is evident at once that there is no relationship between them and *Œnonites exactus*.

Œnonites permistus sp. nov.

Maxilla I, plate IV, fig. 13

The jaw is sub-triangular in outline and measures 1.1 mm. in length. In a typical specimen a series of twenty-three denticles is present along the inner margin. The inner margin is straight for most of its length, but curves posteriorly. The first thirteen denticles are conical, very sharply pointed, and perpendicular to the inner margin of the jaw. The second denticle is the largest and, together with the slightly smaller first denticle, it acted in the capacity of the fang. Following the large second denticle is a series of nine small, rather uniform teeth. They are followed by two larger denticles. The remaining denticles are of a different character, being rather blunt in comparison, triangular in outline, and directed backward. They extend to the posterior end. The outer margin is straight from the curved anterior end to a point about mid-way, where it forms a sharp angle and incurves to the acute posterior extremity. The wide fossa begins just anterior to the mid-region and narrows abruptly to the posterior end. The upper and lower surfaces are gently convex with some irregularities in the extreme posterior region.

The arrangement and character of the denticles of this species are of particular interest. This is especially true of the second denticle which is larger than the first and probably served as the fang. This position gives it a better foundation on the jaw. If, in a mechanical

sense, the muscle and the fossa acted as a fulcrum, it is probable that a fang-like denticle located a little closer to the center (or closer to the muscle) would have more strength and holding power. On the other hand, this position of the fang would lessen the reaching ability. The tendency of a larger, fang-like denticle to appear second or even fourth in position is not uncommon. Among the forms described in this paper, *Œnonites exactus* and *Œnonites levis* have an anterior denticle, other than the first one, developed in the form of a fang. By and large, this species does not resemble closely any of the others. There is a similarity, in general outline and in position of the fossa, of *Œnonites naviformis* Hinde (1882) and *Œnonites permistus*. *Œnonites exactus* m. and *Œnonites levis* m. have characters which are somewhat similar to those of *Œnonites permistus*.

Œnonites lewistonensis sp. nov.

Maxilla I, plate V, figs. 1, 2

The jaw is small, measuring only 0.6 mm. in length. A series of nine, blunt or sharply pointed denticles extends along the inner margin to about one-fourth the distance from the posterior end. The fang is large, pointed, and strongly hooked. Adjacent to and more or less coalesced with the fang are two, compact, forward pointing denticles. There is a small space between them and the next denticle. The remaining denticles are fairly large for the size of the jaw and are directed backward. The irregularly curved outer margins continue around the posterior extremity to the inner margin where they meet in a slightly acute ending. The fossa is long, narrow, and deep. It begins well in the anterior part of the jaw and continues around the posterior end. The upper and lower surfaces of the jaw are generally convex, although there are areas which are irregular and slightly concave.

This form cannot be closely correlated with any other described species. However, the anterior end, including the fang and first denticles, is like that of certain species of *Lumbriconereites*. There is a slight similarity to *Œnonites naviformis* Hinde (1882) but in *Œnonites lewistonensis* the posterior end is wider and the denticles are of a different character and arrangement.

Œnonites bidens sp. nov.

Maxilla I, plate V, figs. 3-5

The jaw is small and elongate. From nine to thirteen, sharp, conical, mostly backward directed denticles are present on the curved

inner margin. The fang and second denticles are practically mirror images of each other and are more or less coalesced. Both denticles are directed slightly forward. Following these teeth is a vacant space on the margin about one-third the distance from the anterior end. From this point the denticles are small but increase in size to about the middle and then decrease in size to the posterior end. The outer margin is broadly curved from the front end to just anterior to the mid-region where it is gently incurved to an acute posterior extremity. The fossa is small, oval, and is in the posterior half of the jaw. Both the upper and lower surfaces are convex except for the area adjacent to the second denticle and the inner margin. An average specimen measures .65 mm. in length.

Specimens of this kind are not very common in the collection. This species demonstrates the tendency of a second denticle to support the fang. *Œnonites coalescens* m. is very similar in outline and general character to this species. It differs by being much larger and by lacking the space on the inner margin between the second and third denticles. The adhesion of the second denticle to the fang is a similarity in both species.

Œnonites triangulus sp. nov.

Maxilla II, plate V, figs. 6, 7

The jaw is triangular in cross-section and measures about .60 mm. in length. Along the strongly incurved or arched inner margin is a series of twelve, blunt, compact denticles which extends to the posterior end. In the anterior part the denticles are fairly large but they diminish rapidly in size in the posterior region. The first denticle or fang is slightly larger than the others and points in a forward direction. The outer margins are curved with well rounded edges. The upper surface is highly convex. The lower surface is gently concave. The fossa extends nearly the full length of the form; it is not very wide at the center and narrows to an acute angle at both the anterior and posterior ends.

This form is similar to *Œnonites radula* Hinde (1882) from the Silurian of Gotland except that it is more strongly arched, less triangular in outline, and the fossa is not so wide. *Œnonites triangulus* resembles *Œnonites kopfi* m. in a general way. It differs by having a more curved or arched inner margin, a fossa which is not as wide at the anterior end, and a less triangular outline. *Œnonites triangulus* also differs from *Œnonites kopfi* m. by having the outer margin rounded

from the anterior end instead of being straight or incurved to a sharply pointed shank.

Œnonites (?) **franci** sp. nov.

Maxilla I, plate V, figs. 8, 9

The jaw is narrow and elongate, measuring 1.1 mm. in length. A straight inner margin bears a series of ten to twelve, large, backward directed denticles which does not extend to the posterior extremity. They diminish in size posteriorly. The fang is large, oval in cross-section, and is strongly hooked. The outer margins are parallel and slightly curved to the blunt posterior extremity. The lower surface is mostly convex but in some specimens it is slightly concave or flattened just adjacent to the denticles and the posterior end. The upper surface is strongly convex, except for the fossa and a small area at the posterior extremity. The fossa, which is fairly deep, long, and oval, extends about two-thirds the length of the jaw, almost to the posterior end.

There is some doubt as to the genus in which this form should be placed. It might be placed in the genus *Arabellites*. Hinde (1879) described Arabellites (Maxilla I), as a "Jaw with an extremely prominent anterior hook, and a row of smaller teeth on a wide base." This species conforms with the first qualification but it does not, however, possess a wide base. In *Œnonites* (?) *franci*, in the writer's opinion, the large fossa, which extends almost to the anterior end, and the small posterior extremity, are not quite characteristic for the fossil genus *Arabellites*. Likewise, such characteristics are not found, so far as the writer is aware, in the Maxilla I of the recent genus *Arabella*. The posterior extremity of the jaws of Maxilla I of the genus *Arabella* is usually truncate and there are surfaces present for articulation with the carriers. In species of *Arabellites* with truncate posterior ends, the fossa or areas for muscle attachment are small and are located in the posterior third of the jaw. Hinde (1879) erected the genus *Œnonites* to include forms having "Jaws with a more or less curved anterior hook followed by a series of smaller teeth, similar in character to those of the existing genus *Œnone*." The form described above does not conflict with any of the characters of *Œnonites* and for the present the species will be included in that genus. There is a slight resemblance between *Œnonites serratus* Hinde (1879) and *Œnonites franci*. *Eunicites trentonensis* Caley (1936) has the same general shape as *Œnonites franci*, but in the former the anterior denticles begin close to the fang.

Œnonites acinaces sp. nov.

Maxilla I, plate V, figs. 10-14

The jaw is short and narrow, measuring from 0.57 mm. to 1.18 mm. in length. Along the straight inner margin is a series of nine or ten, large, conical, sharply pointed denticles extending to the posterior extremity. The first denticle, or fang, is very long, straight or slightly hooked, oval in cross-section, and usually pointed in a forward direction. The next two or three teeth are smaller and are followed by a large flattened denticle. Of the remaining five denticles, the first three are small and the remaining two are somewhat larger. The denticles are usually perpendicular to the inner margin but may be directed slightly backward. The outer margins are parallel and are curved to the posterior extremity and last denticle. The anterior margin is quite straight and terminated with the outer margins in a sharp point. The fossa is long, very narrow, and opposite the inner margin. At the anterior end, the fossa opposite the fang is slightly enlarged. The margins of the fossa are narrow and the edges rounded except at the anterior end where they are wider and quite flat. The upper surface is arched or convex while the lower surface is concave. In some specimens both surfaces are gently convex or flattened.

The very large, formidable denticles situated on such a small base, together with a narrow fossa, make this form very interesting. Perhaps the long sharp denticles counteract the ineffectiveness of the weak muscles which are indicated by the small fossa. In specimens where surfaces are slightly convex or flattened, it is difficult to tell whether the jaws are right or left ones. *Œnonites acinaces* does not correspond readily with other species of *Œnonites* although it possesses the characters of that genus.

Genus ILDRAITES, Eller, 1936

Ildraites geminus sp. nov.

Maxilla I, plate VI, figs. 1-5

The jaw is elongate, quite wide anteriorly, and tapers to an acute posterior extremity. Length of the specimens ranges from .60 mm. to 1.42 mm. On the gently curved inner margin a series of from sixteen to twenty-three conically shaped denticles extends almost to the posterior end. The first two denticles, which constitute the fang, are small and thin, and may be coalesced or separated by a small space. They are slightly hooked and usually point in a backward direction, oblique to the lower surface. The next six to eleven denticles are very small and are perpendicular to the inner margin or may, especially the

anterior teeth, point in a forward direction. The remainder of the denticles are large and gradually diminish to a minute size at the posterior extremity. The inner margin is notched in the posterior part by a deep, wide crescent-shaped bight. From the acute shank formed by the bight, the outer margin incurves to the anterior end. The fossa is of medium size and is limited to the posterior half of the jaw. Thick margins with well rounded edges surround the fossa. The upper surface of the jaw is highly convex while the lower surface is usually concave and irregular.

This form is similar to *Ildraites duplex* m. but differs by having denticles, smaller in size and different in shape, along the whole inner margin. *Ildraites geminus* is more arched, the lower surface more concave, and the shank more acute than in *Ildraites duplex* m. Stauffer (1939) described three species, *Lumbriconereites expansus* Stauffer, *Eunicites grandis* Stauffer, and *Arabellites priscus* Stauffer, which, judging from the figures, seem to resemble each other quite closely and correspond, except for the second denticle, to *Ildraites geminus* m.

Ildraites horridus sp. nov.

Maxilla I, plate VI, figs. 6-9

The left and right jaws are asymmetrical, rudely triangular in shape, and measure from 1.01 mm. to 1.59 mm. in length. A broadly curved inner margin bears a series of conical, sharply-pointed denticles, eight on the right jaw and from eleven to thirteen on the left jaw. The fang of the right jaw is very large, conical, and points in a backward direction. On the left jaw the fang is smaller and extends in a forward direction. In most specimens the second denticle is usually small but may be quite large. Two specimens do not have a second denticle in the usual place. The third denticle is very large in both right and left jaws. The remaining denticles are of various sizes and are not arranged in any particular order. The denticles point in a backward direction and extend along the narrow posterior to the blunt extremity. The anterior margin incurves to a long, acutely pointed shank. A deep, crescent-shaped bight on the outer margin emphasizes the narrow shank. Two-thirds of the length of the jaw are taken by a wide, deep fossa. The outer margins of the fossa are not thickened but the edges are well rounded. The upper and lower surfaces are convex except for a slight concave area at the third denticle on the lower surface.

Most of the jaws were found in a broken condition, but a few complete specimens made a description possible. The jaws are rather unique, being unlike any other species except possibly *Arabellites cervicornis* Hinde (1879) and *Arabellites anglicus* Hinde (1880).

Ildraites duplex sp. nov.

Maxilla I, plate VII, figs. 5-6

The jaw is elongate with a rather wide anterior region. Measurements in length range from .71 mm. to 1.48 mm. Along the gently curved inner margin a series of nine to fourteen triangular shaped denticles extends nearly to the acute posterior extremity. The first and second denticles are very large, the second usually slightly larger than the first. These two denticles are very close together and act as the fang. A vacant space is present between these two denticles and the next tooth. On some specimens the third, fourth, and fifth denticles are minute. Following them, are several large teeth which gradually diminish in size posteriorly. The first two denticles are directed forward or are perpendicular to the inner margin, the remainder are pointed in a backward direction. The outer margin is slightly curved to about the mid-region where it is notched by a shallow, crescent-shaped bight. The fossa is deep and of medium size. Its margins are thick and the edges well rounded. The upper surface is strongly convex. The lower surface is usually slightly convex but may be concave in the mid-regions and near the fang.

This form is related to several other species and is similar to them except for a difference in the first two denticles. The interesting arrangement in which the first and second denticles are almost of the same size and act as a fang was noticed also in other species of this fauna. *Arabellites angustus* Hinde, *Arabellites arcuatus* Hinde, and *Arabellites anglicus* Hinde (1882), agree with *Ildraites duplex*, but only in a general way. A slight similarity exists between *Ildraites* (*Arabellites*) *marcellusensis* (Eller) (1934), *Ildraites bipennis* (Eller) (1936), *Ildraites peramplus* m., and *Ildraites duplex*.

Ildraites peramplus sp. nov.

Maxilla I, plate VII, figs. 7-9

The jaw is long and wide, measuring from 1.1 mm. to 1.6 mm. in length. On the straight inner margin is a series of nine or ten, conical, pointed denticles which are directed sharply backwards. The first five or six denticles are rather large and uniform in size. The remaining denticles are smaller and continue nearly to the acute posterior extremity. A large fang is curved backward, oblique to the plane of the lower surface. The outer margin is straight from the fang to about two-thirds of the length of the jaw where it is notched by a deep, crescent-shaped bight. A long wide fossa, beginning at about the base of the fang and extending to the posterior extremity, is present on the

upper surface. The fossa is deep or concave near the margins but flattened or slightly convex in the central area. The margins of the fossa are narrow; the edges rounded. The lower surface is convex but in some specimens it may be slightly flattened in the middle region.

Hinde (1880, 1882) placed species of this kind under the genus *Arabellites*. The writer (1936) erected a genus, *Ildraites*, for forms with the anterior end similar to *Arabellites* but having a posterior end and outer margin notched by a deep, crescent-shaped indentation or bight. Hinde (1879), in erecting the genus *Arabellites*, included forms with "(2). Sickle-shaped jaws and allied forms" and further explained "the second resemble the second pair (Maxilla II)" of *Arabella* (*Œnone*) *maculata* Edwards, as figured in Cuvier's "Regne Animal." The forms described under the genus *Ildraites* are of Maxilla I; have a different type of muscular attachment, and do not possess any apparent surfaces for the articulation of carriers. Hinde (1882) described a species, *Arabellites spicatus* Hinde, and under "remarks" said, "This jaw appears to represent the pincers (Maxilla I), although there is not indication of any attachment as there is in the normal types of the existing genus *Arabella*." There is a close resemblance between *Ildraites* (*Arabellites*) *marcellusensis* (Eller, 1934) and *Ildraites peramplus*. *Ildraites bipennis* (Eller, 1936) is similar to *Ildraites peramplus*, except for the denticles, which, in the former, do not extend as far along the inner margin.

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EXPLANATION OF PLATE I

Figures magnified about 35 times.

Numerals in parentheses at the right indicate the Carnegie Museum catalogue numbers of the respective specimens.

FIG. 1. *Lumbriconereites hibbardi* sp. nov. Maxilla I, left jaw, side view (17751).

FIGS. 2, 3. *Lumbriconereites hibbardi* sp. nov. Maxilla I, right jaw (17754).
FIG. 2. Under side.
FIG. 3. Upper side.

FIG. 4. *Lumbriconereites hibbardi* sp. nov. Maxilla I, right jaw, side view (17749).

FIG. 5. *Lumbriconereites hibbardi* sp. nov. Maxilla I, left jaw, side view (17755).

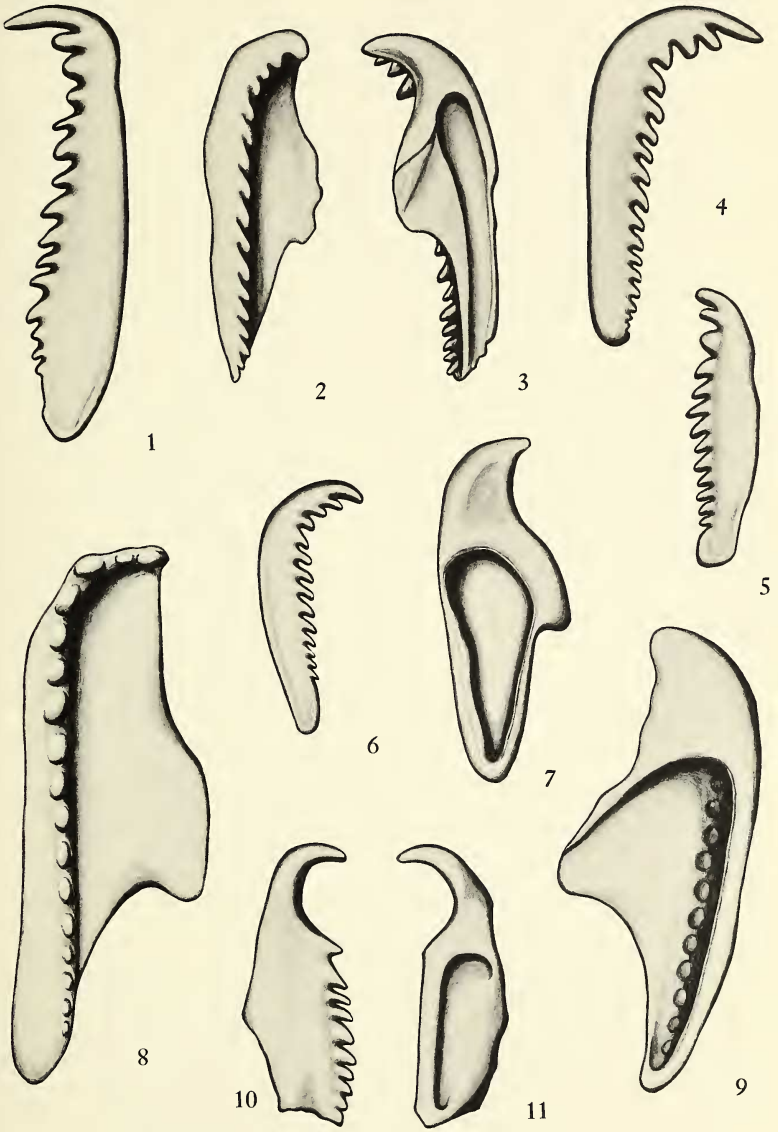
FIG. 6. *Lumbriconereites hibbardi* sp. nov. Maxilla I, right jaw, side view (17750).

FIG. 7. *Lumbriconereites hibbardi* sp. nov. Maxilla I, left jaw, upper side (17756).

FIG. 8. *Lumbriconereites hibbardi* sp. nov. Maxilla I, right jaw, under side (17753).

FIG. 9. *Lumbriconereites hibbardi* sp. nov. Maxilla I, right jaw, upper side (17752).

FIGS. 10, 11. *Arabellites oviformis* sp. nov. Maxilla I, right jaw. (17769).
FIG. 10, under side;
FIG. 11, upper side.



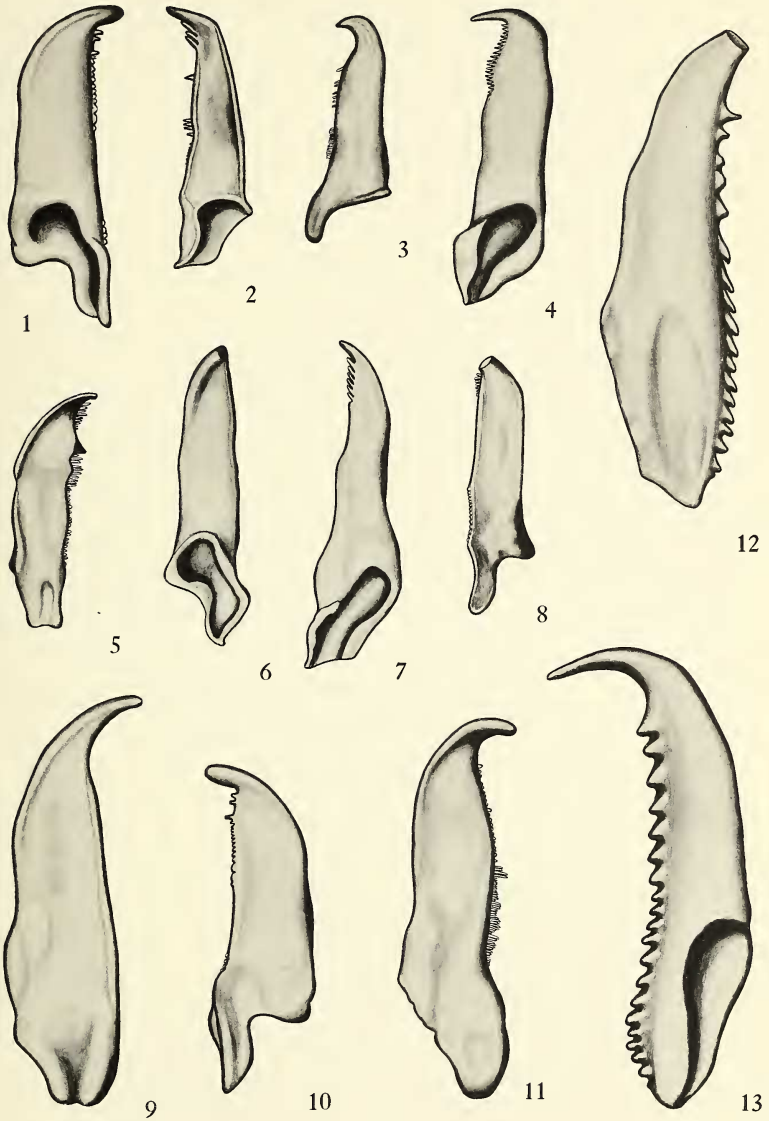
Scolecodonts from Silurian of New York.

EXPLANATION OF PLATE II

Figures magnified about 35 times.

Numerals in parentheses at the right indicate the Carnegie Museum catalogue numbers of the respective specimens.

FIG. 1. *Nereidavus invisibilis* sp. nov. Maxilla I, left jaw, upper side (17765).
FIG. 2. *Nereidavus invisibilis* sp. nov. Maxilla I, right jaw, upper side (17763).
FIG. 3. *Nereidavus invisibilis* sp. nov. Maxilla I, left jaw, under side (17760).
FIG. 4. *Nereidavus invisibilis* sp. nov. Maxilla I, right jaw, upper side (17759).
FIG. 5. *Nereidavus invisibilis* sp. nov. Maxilla I, right jaw, under side (17758).
FIG. 6. *Nereidavus invisibilis* sp. nov. Maxilla I, left jaw, upper side (17766).
FIG. 7. *Nereidavus invisibilis* sp. nov. Maxilla I, right jaw, upper side (17762).
FIG. 8. *Nereidavus invisibilis* sp. nov. Maxilla I, left jaw, under side (17757).
FIG. 9. *Nereidavus invisibilis* sp. nov. Maxilla I, right jaw, under side (17764).
FIG. 10. *Nereidavus invisibilis* sp. nov. Maxilla I, left jaw, under side (17765).
FIG. 11. *Nereidavus invisibilis* sp. nov. Maxilla I, right jaw, under side (17767).
FIG. 12. *Arabellites plenidens* sp. nov. Maxilla I, right jaw, under side (17775).
FIG. 13. *Arabellites plenidens* sp. nov. Maxilla I, right jaw, upper side (17774).



Scolecodonts from Silurian of New York.

EXPLANATION OF PLATE III

Figures magnified about 35 times.

Numerals in parentheses at the right indicate the Carnegie Museum catalogue numbers of the respective specimens.

FIGS. 1, 2. *Arabellites rectidens* sp. nov. Maxilla I, right jaw (17770).
FIG. 1. Under side.
FIG. 2. Upper side.

FIG. 3. *Arabellites rectidens* sp. nov. Maxilla I, left jaw, side view (17772).

FIGS. 4, 5. *Arabellites rectidens* sp. nov. Maxilla I, right jaw (17771).
FIG. 4. Under side.
FIG. 5. Upper side.

FIG. 6. *Eunicites vertex* sp. nov. Maxilla II, right jaw, under side (17749).

FIG. 7. *Eunicites petasus* sp. nov. Maxilla I, left jaw, under side (17768).

FIG. 8. *Eunicites petasus* sp. nov. Maxilla I, right jaw, upper side (17749).

FIG. 9. *Œnonites parvidentatus* sp. nov. Maxilla I, left jaw, under side (17787).

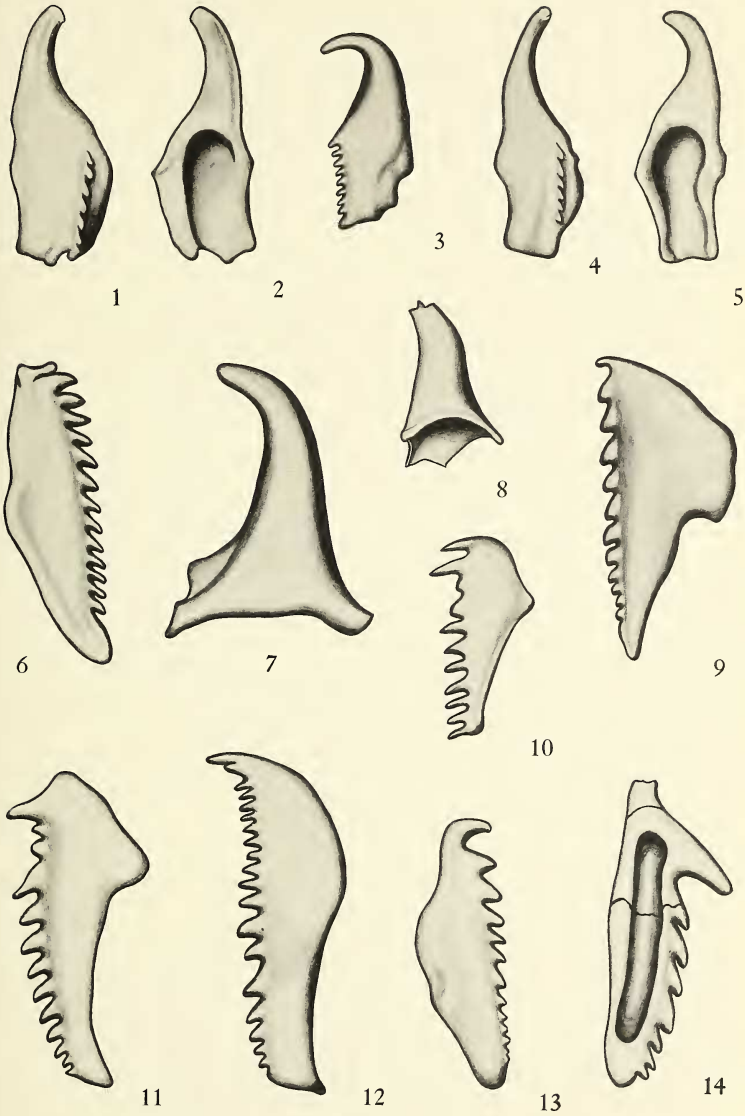
FIG. 10. *Œnonites levis* sp. nov. Maxilla II, left jaw, under side (17791).

FIG. 11. *Œnonites albionensis* sp. nov. Maxilla II, left jaw, under side (17749).

FIG. 12. *Œnonites coalescens* sp. nov. Maxilla I, left jaw, under side (17786).

FIG. 13. *Œnonites staufferi* sp. nov. Maxilla II, right jaw, under side (17792).

FIG. 14. *Œnonites fossulus* sp. nov. Maxilla I ?, left jaw, upper side (17782).



Scolecodonts from Silurian of New York.

EXPLANATION OF PLATE IV

Figures magnified about 35 times.

Numerals in parentheses at the right indicate the Carnegie Museum catalogue numbers of the respective specimens.

FIG. 1. *Œnonites kopfi* sp. nov. Maxilla II, left jaw, upper side (17790).
FIG. 2. *Œnonites kopfi* sp. nov. Maxilla II, left jaw, under side (17749).
FIG. 3. *Œnonites kopfi* sp. nov. Maxilla II, left jaw, under side (17790).
FIG. 4. *Œnonites fornicatus* sp. nov. Maxilla II, left jaw, upper side (17789).
FIG. 5. *Œnonites fornicatus* sp. nov. Maxilla II, left jaw, under side (17749).
FIG. 6. *Œnonites fornicatus* sp. nov. Maxilla II, left jaw, under side (17774).
FIG. 7. *Œnonites peracutus* sp. nov. Maxilla I, left jaw, upper side (17763).
FIG. 8. *Œnonites peracutus* sp. nov. Maxilla I, left jaw, upper side (17783).
FIG. 9. *Œnonites flexus* sp. nov. Maxilla I, left jaw, under side (17778).
FIG. 10. *Œnonites flexus* sp. nov. Maxilla I, right jaw, under side (17772).
FIG. 11. *Œnonites exactus* sp. nov. Maxilla I, left jaw, upper side (17788).
FIG. 12. *Œnonites exactus* sp. nov. Maxilla I, left jaw, upper side (17773).
FIG. 13. *Œnonites permistus* sp. nov. Maxilla I, left jaw, under side (17779).